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Title

The comparison of the mode of communication between students with hearing impairment in Japan and Sweden

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Abstract

Background: Many studies have presented the benefit of early detection and intervention for children with a hearing loss. However, the definition of total communication and the share of communication modes by children including a moderate hearing loss are not clearly shown. Furthermore, we know little about audiological habilitation in other countries than the U.S. and Australia.

Aim: To investigate the modes of communication by the Japanese and Swedish children in the school for the Deaf both in Tokyo, Japan and Gothenburg, Sweden.

Material and method: Eight students 10 to 11 years old with a moderate to severe hearing loss at the school for the Deaf in Tokyo and Gothenburg were chosen. Four pairs were composed by matched audiological criteria. The share of the communication modes scaled by the investigator was observed through a class visit and compared in each pair.

Result: We found that the Japanese students mixed oral communication and the sign language whereas the Swedish students used only oral communication.

Discussion: The influences of cultural differences, age of diagnosis, hearing aid fitting, the educational setting emphasized oral communication, the teacher preference of communication modes, and the parent's choice on school placements were discussed.

Key words: hearing loss, mode of communication, identification, intervention, educational setting.

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Titel

Jämförelse med kommunikationssätt mellan studenter med hörselnedsättning i Japan och Sverige

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Sammanfattning

Bakgrund: Många studier har presenterat fördelen av tidig upptäckt och tidig intervention för spädbarn med en hörselnedsättning. Definitionen av total communication och andelen av kommunikationssätten hos barnen inkluderat en måttlig hörselnedsättning visas dock inte tydligt. Dessutom vet man lite om audiologisk habilitering i andra länder än USA och Australien.

Syfte: Att undersöka kommunikationssätt hos japanska och svenska barn i dövskolan både i Tokyo, Japan och Göteborg, Sverige.

Material och metod: Åtta elever, 10 till 11 år, med en måttlig till grav hörselnedsättning i dövskolan i Tokyo och Göteborg var utvalda. Fyra par bildades utifrån audiologiska kriterier. Andelen av kommunikationssätten skalad av undersökaren observerades vid klassbesöket och jämfördes i varje par.

Resultat: De japanska eleverna blandade muntlig kommunikation och teckenspråket, medan de svenska eleverna använde endast muntlig kommunikation.

Diskussion: Påverkan av kulturella skillnader, ålder vid diagnos och hörapparatanpassning, en pedagogisk inställning som lägger tonvikt på oral kommunikation, det kommunikationssätt som läraren föredrar och föräldrarnas val av skolplacering, diskuteras här..

Nyckelord: hörselnedsättning, kommunikationssätt, identifiering, intervention, pedagogisk inställning.

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CONTENTS

BACKGROUND

Early hearing detection and intervention

A hearing loss in infants and small children is hidden, because they can not express themselves as adults do and tell those around them that they don't hear well (1). Harrison and Roush (2) researched the status of identification and intervention for infants and young children with a hearing loss with a nationwide perspective in the U.S. They found that the median ages at a) parents' suspicion of the hearing loss, b) diagnosis for hearing impairment, c) a hearing aid fitting, and d) the ages at the intervention were lower by risk children than those by no risk children who had the same severity of the hearing loss. The studied median ages by the no risk children with a mild to moderate hearing loss were a) 15, b) 22, c) 28 and d) 28 months, whereas those by the risk children were a) 8, b) 12, c) 22 and d) 18 months. The studied median ages by the no risk children who had a severe to profound hearing loss were a) 8, b) 13, c) 16 and d) 16 months and those by the risk children were a) 7, b) 12, c) 15 and d) 16 months. These results showed that the studied ages decreased and the time intervals between variables became shorter in both children with risk and no risk when they had the more severe degree of the hearing loss. A study in Iran (3) presented that the mean ages of suspicion, diagnosis, amplification and intervention by participants who had a profound hearing loss were 12.6 ± 8.9, 15.2 ± 9.3, 20.5 ± 11.1 and 22.3 ± 11.6 months. According to the results of these studies, the hearing loss in children with risk factors or the more severe degree of the hearing loss is most likely detected in the first year of the life.

Joint Committee on Infant Hearing (JCIH) (4) endorses early detection of a hearing loss and early intervention of hearing habilitation for all infants with hearing loss with the program called Early Hearing Detection and Intervention (EHDI). The program emphasizes that the screening of hearing for the infants should be done at no later than one month after the birth, and audiological/medical evaluation for those with a hearing loss at no later than three months of age. The specialized hearing habilitation for infants with a confirmed hearing loss will begin at no later than six months of age. With the EHDI program, a congenital permanent bilateral, unilateral sensory, conductive or neural hearing loss can be identified in newborn babies. EHDI has a goal to maximize linguistic competence and literacy development for children with a hearing loss through providing amplification and enrollment in early intervention.

Acquisition of spoken language in hearing impaired children

There are two motives for the early fitting of hearing instruments for children with a hearing loss. One is that they will hear and experience the environmental sound by hearing aids or cochlear implants so that it improves the quality of life for them and their caregivers. The other is that neural connections will be formed from the cochleae through auditory nerves when they receive auditory stimuli through their hearing aids or the cochlear implants (5). The development of the auditory perceptions begins at a very early period and effects speech and language development. An infant with deafness who becomes old without an ability to hear speech has no chance of fully developing speech to communicate in a hearing society (1). Hearing children acquire a language from what they hear or see around them. Children with a severe or profound congenital hearing loss have an obvious difficulty in acquiring a spoken language through the auditory channel (6).

The study by Yoshinaga-Itano et al. (7) indicated that the early identification of a hearing loss and the early intervention of hearing habilitation for children before six months of age resulted in significantly better language development than those for children after six months of age. According to this study, the language advantage is found if a child has normal cognitive abilities and its hearing habilitation begins before six months of age. Some other findings also show significant correlations between speech and language skills and the age of intervention. Moeller (8) found that the early enrollment in intervention by 11 months of age was associated with better language development in children, regardless of the severity of a hearing loss. Geers (9) examined a relationship between the age at cochlear implantation or the duration of implant use and language abilities in children who received a cochlear implant by five years of age. The result of this study demonstrated the children who underwent the implantation at two years of age had equal speech and language skills to normal hearing peers at same age than those at four years of age. Moreover, that result showed that 80% of children who received a cochlear implant within a year of onset of deafness demonstrated normal speech and language skills. Ramkalawan and Davis' (10) found that the children who had received early intervention for their hearing loss had better language production in conversation than those who had later intervention.

Mode of communication

There are some communication modes which children with a hearing loss, deafness and those around them use. Two of them are oral communication and total communication. Oral

communication is maximizing the use of aided residual hearing, speech reading, facial expressions and naturally occurring gestures to develop spoken language. Total communication utilises multiple modalities such as signs, gestures, speech reading and hearing are used simultaneously (11).

Vesterager and Parving (12) found in their study that 93% of participants with the severity of a hearing loss less than 75 dB used oral communication and 7% used sign language, whereas 25% of those with the hearing loss more than 75 dB used oral communication and 75% used sign language. All participants were enrolled in intervention at the median age of 12 months. This result shows that the age at the intervention was not related to the primary language. Tobey et al. (13) examined the influence of classroom placement and the mode of communication in congenitally deaf children who received a cochlear implant before 5 years of age. The findings demonstrated the educational settings which emphasize oral communication development resulted in the participants higher speech intelligibility scores than those in special education placements (13). An another study found the educational placement which emphasized speech and audition for communication led to better language outcomes for the children who had an onset of deafness before 3 years of age and received cochlear implants by 5 years of age (14). According to these studies, the educational setting and the mode of communication at schools most likely influence the language performance after the fitting of the hearing aids or cochlear implants.

However, these studies have no definition of the total communication. Moreover, it is not clearly illustrated a common mode of communication by participants. By classifying the common mode of communication and investigating it by children with hearing impairment, the variable which greatly influences the determination of the mode of communication under the hearing habilitation period can be found.
Furthermore, the audiological habilitation for children with hearing impairment seems to be different in each country. Articles generally orginiate from the U.S and Australia, however little is known about other countries. There are not so many studies about Japan and Sweden and the use of communication modes by children with the hearing impairment with a moderate hearing loss. In Japan, children with a hearing loss will go to a school for the Deaf or a mainstream school. In some mainstream schools, there is a special class or a resource room, where children with a hearing loss can receive special education. The final decision on school placement is done by the local educational board (16). By studying and comparing the

modes of communication in children with a moderate hearing impairment in Japan and Sweden, the present condition of the hearing habilitation for those children in developed countries in the east and west can be made. Moreover, the cultural differences between two countries and the influence of these on the audiological habilitation can be illustrated.

AIM

The aim of this research study is to investigate the modes of communication by the Japanese and Swedish children in the school for the Deaf both in Tokyo, Japan and Gothenburg, Sweden.

Specific questions

- Are there any differences in modes of communication?
- Does time of diagnosis and/or hearing aid fitting effect the mode of communication used?
- Is there a difference between which mode of communication is used by the students in Tokyo and Gothenburg?

MATERIAL

Eight children with a moderate to severe hearing loss who attended at the school for the Deaf in Tokyo (N=4) and the school for the Deaf and Hard of hearing in Gothenburg (N=4) participated in the study. Their hearing losses were symmetric and asymmetric. The participants wore hearing aids bilaterally in the class, except one child who was fitted unilaterally. No one had a cochlear implant.

Japanese subjects

Four Japanese children with a moderate to severe hearing loss were chosen through the audiological data from the archive at the school for the Deaf in Tokyo. Tables 1 and 2 show the summary of the medical and audiological records of them, including: age at time of researching, age of diagnosis, aetiology, age they began to use hearing aids, unilateral or bilateral fitting, aided and unaided Pure Tone Average (PTA: 0.5, 1 and 2 kHz), audiogram

configuration, and total years of attending the school for the Deaf. With the exception of student 3-J, they had no other disabilities. Student 3-J has mild intellectual disability.

Table 1. Summary of medical records of the Japanese students.

Student	Age	Age of diagnosis	Aetiology	Age of beginning hearing aids	Uni-/bilateral fitting	Total years at present school
1-J	10 yr	2 yr 6 m	unknown	5 yr 9 m	Bilateral	3 yr 10 m
2-J	11 yr	6 m	unknown	11 m	Unilateral(Left)	4 yr 10 m
3-J	11 yr	4 yr 10 m	undeveloped ossicles	5 yr	Bilateral	4 yr 10 m
4-J	11 yr	3 yr	unknown	3 yr	Bilateral	3 yr 10 m

Table 2. Summary of audiological records of the Japanese students.

Student	Audiogram configuration	Unaided PTA R/L (dB HL)	Difference between the ears	Aided PTA R/L (dB HL)	Difference between the ears
1-J	scoop	83/86	3 dB	40/45	5 dB
2-J	scoop	85/71	14 dB	- /25	-
3-J	rising	68/54	14 dB	60/58	2 dB
4-J	sloping	96/90	6 dB	50/40	10 dB

Swedish subjects

Four Swedish children who matched on the Japanese students were chosen with the help of the professional at the unit of hearing diagnosis and habilitation for child and adolescence at Sahlgrenska University (SU) Hospital. Tables 3 and 4 show the summary of the medical and audiological records of them. They had no other disabilities other than hearing impairment.

Table 3. Summary of medical records of the Swedish students.

Student	Age	Age of diagnosis	Aetiology	Age of beginning hearing aids	Uni-/bilateral fitting	Total years at present school
1-S	10 yr	1 yr 6 m	unknown	1 yr 8 m	Bilateral	4 yr 6 m
2-S	11 yr	3 yr 6 m	unknown	3 yr 7 m	Bilateral	4 yr 6 m
3-S	11 yr	2 yr 2 m	heredity	2 yr 3 m	Bilateral	4 yr 6 m
4-S	11 yr	2 yr 3 m	unknown	2 yr 5 m	Bilateral	4 yr 6 m

Table 4. Summary of audiological records of the Swedish students.

Student	Audiogram configuration	Unaided PTA R/L (dB HL)	Difference between the ears	Aided PTA R/L (dB HL)	Difference between the ears
1-S	scoop	83/90	7 dB	25/52	27 dB
2-S	sloping	67/83	16 dB	47/38	9 dB
3-S	flat	60/62	2 dB	35/35	0 dB
4-S	scoop	82/65	17 dB	43/42	1 dB

METHOD

Data collection

This research was a prospective study. Data collection included a class visit during which the chosen students were observed for 1 to 1 and a half hours. In Japan, there were two students in 4th grade and six students in 5th grade. The students in each class had various severities of hearing losses from moderate to profound so that it was one of the rules to use both sign language and speech at the school. They had one class teacher. The students in the 4th grade had a science lesson and the 5th grade students had a Japanese lesson. During the lessons, the teacher used sign and speech to communicate. Each classroom was equipped with an infrared transmission system. Students wore a receiver, which was coupled to their hearing aids. Hearing aids and the infrared transmission system were used during the observation.

In Sweden, there were two types of classes, a Hearing class and a Deaf class, at the school for the Deaf and Hard of hearing in Gothenburg. There were six students in the 5th grade in the Hearing class and they had Swedish and mathematic lessons. There were two class teachers and they mostly used speech during the lesson. The sign language was used as support. All the chosen students wore hearing aids during the lessons. At the school, they had a loop system in the classrooms. The students used T + M mode under the observation time which allowed them to access the loop system.

The mode of communication by each student was observed throughout the class visit by the principal investigator. The focus of the observation was to find out which mode of communication was mostly used by the students. It was rated with numbers according to the scale in Table 5.

Table 5. Scale for classification of the share of communication modes by the principal investigator.

Nr.	Scale for the share of communication modes.
1	The student spontaneously uses only sign language.
2	The student uses mostly sign language and mixes little speech at the same time.
3	The student mixes both sign language and oral communication same amount at the same time.
4	The student uses mostly oral communication and mixes little sign at the same time.
5	The student spontaneously uses only oral communication.

Criteria for matching the students in Japan and Sweden included: age at time of researching and unaided PTA (PTA: 0.5, 1 and 2 kHz), which is presented in Table 6. Children were excluded if they were younger or older than 10 and 11 years, if they had other severe disabilities other than hearing impairment, if they didn't use hearing aids, and if their hearing loss was less than 50 dB HL or more than 100 dB HL.

Table 6. Summary of matched students by criteria.

Pair	Matched students	Age at research	Unaided PTA (0.5, 1 and 2kHz) Right/Left (dB HL)
1	1-J	10 years	83/86
	1-S	10 years	83/90
2	2-J	11 years	85/71
	2-S	11 years	67/83
3	3-J	11 years	68/54
	3-S	11 years	60/62
4	4-J	11 years	96/90
	4-S	11 years	82/65

Data analysis

The modes of communication by the Japanese and Swedish students were evaluated in numerical value according to scale (Table 5). Each value between them was compared. It included age at time of researching, age of diagnosis, aetiology, age at they began to use

hearing aids, unilateral or bilateral fitting, PTA with aided and unaided, audiogram configuration and total years of the attending at the school for the Deaf (Tables 1 - 4).

RESULTS

The mode of communication in the classroom

Figure 1 shows the results of the communication modes by the Japanese and Swedish students.

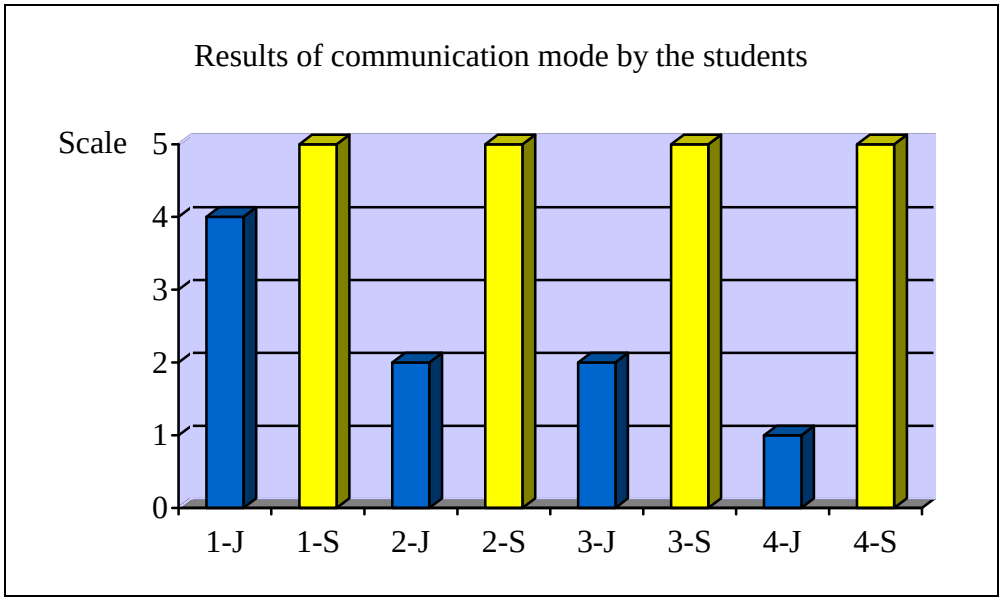

Figure 1. Results of communication mode by the students. Scaled by Table 7.

Table 7. Scale for classification of the share of communication modes by the principal investigator.

Nr.	Scale for the share of communication modes.
1	The student spontaneously uses only sign language.
2	The student uses mostly sign language and mixes little speech at the same time.
3	The student mixes both sign language and oral communication same amount at the same time.
4	The student uses mostly oral communication and mixes little sign at the same time.
5	The student spontaneously uses only oral communication.

Japanese students

The modes of communication by the Japanese students spread from 1 to 4 (Figure 1). They used oral communication and sign language when they answered the teacher and spoke to the entire class. When they talked to themselves and each other, 1-J used mostly the oral communication and the other students mostly used sign language. Table 8 presents the results of communication modes and the quality of their speech.

Table 8. Results of communication mode and quality of speech by the Japanese students.

Students	Scale	Articulation	Prosody
1-J	4	unclear	good
2-J	2	quite clear in short phrases unclear in long sentences	good
3-J	2	very clear in short words	good
4-J	1	unclear	monotone

Swedish students

The mode of communication by all Swedish students was evaluated as 5. They all spontaneously only used oral communication, but their speech production varied (Table 9). Sign language was used when they did a word-memory game in the lesson, because the teachers told them to use it.

Table 9. Results of the communication mode and quality of speech by the Swedish students.

Students	Scale	Articulation	Prosody
1-S	5	very clear	very good
2-S	5	very clear in common phrases unclear in long sentences	good
3-S	5	unclear, all vowels nasally	good
4-S	5	clear, only some vowels unclear	good

DISCUSSION

Method discussion

In this research, two students with a moderate hearing loss were included as participants and their mode of communication and quality of speech was shown in the results. There is an obvious difference in the modes of communication in the classroom between Tokyo and Gothenburg, although they have matched audiological criteria. It is due to the differences in medical and audiological treatment and habilitation in each country. It also seems that it is caused by the cultural difference of how the hearing impairment has been regarded.

There were some difficulties to choose matched students between Tokyo and Gothenburg. All students should have a moderate hearing loss bilaterally. However, there were not many students aged 10 or 11 years old who had no other disabilities other than hearing impairment with a moderate hearing loss. The criterion of unaided PTA was changed from more than 50 dB HL to less than 100 dB HL. Moreover, the criterion of sex matching was excluded to find the matched participants between Tokyo and Gothenburg. The total participants became 8 students in the end, which was suitable for this research.

Results discussion

Influence of age of diagnosis and hearing aid fitting

In this research, the Japanese students mixed oral communication and sign language. The Swedish students spontaneously only used oral communication, regardless of the severity of the hearing loss. This differs from the result in the study of Vesterager and Parving (12).
On the basis of Tables 1 and 3, Table 10 summarizes age of diagnosis (AOD) and age of hearing aid fitting (AOHAF).

Table 10. Summary of the range of AOD and AOHAF, and interval between them.

	Range of AOD	Average of AOD	Range of AOHAF	Average of AOHAF	Interval between AOD and AOHAF
Japanese	6 m – 4 yr 10 m	2 yr 7 m	11 m – 5 yr 9 m	3 yr 7m	1 yr
Swedish	1 yr 6 m – 3 yr 6 m	2 yr 4 m	1 yr 8 m – 3 yr 7 m	2 yr 5 m	1 m

The wide range of the age of diagnosis (AOD) for the Japanese students is illustrated and ranges from 6 months to 4 years and 10 months, while the Swedish students AOD ranges from 1 year and 6 months to 3 years and 6 months. The average age of hearing aid fitting (AOHAF) for the students in Tokyo was 3 years and 7 months, whereas that for the students in Gothenburg was 2 years and 5 months.

The average ages of the diagnosis (AOD) and the intervention (AOHAF) by them were older than JCIH (4) recommended. This is due to newborn hearing screening begun in 2000 in some regions in Japan and in 2007 in the whole of Sweden. Thus the chosen students had probably not been screened within one month after the birth. The student 2-J had perhaps been screened as an at risk child at as an early infant, because 2-J had a sibling who was hearing impaired. Thus, 2-J probably received a diagnosis at six months of age and amplification by a hearing aid at 11 months of age. The student 1-J received hearing aids after 3 years and 3 months from the diagnosis, whereas other students have started amplification by hearing aids within five months after the diagnosis. The student 1-J's value elevated the average age of the hearing aid fitting for the Japanese students.

The Swedish students received hearing aids after one or two months following the diagnosis and started the intervention of the hearing habilitation in a shorter period than for the Japanese students. This short interval of time between the diagnosis and the intervention influenced the result of the communication modes by the Swedish students. This is in agreement with the results presented by Ramkalawan and Davis (10). Moeller (8) also showed the children with hearing impairment, who were enrolled in the early intervention, got language outcomes close to their normal hearing peers, regardless of the degree of a hearing loss.

Influence of class composition

At the school for the Deaf in Tokyo, oral communication and sign language were used simultaneously by the students when they spoke to the teacher. Except 1-J, they used more sign language than oral communication. Sign language was used almost 90% when they talked to each other in the class. Classes at the school for the Deaf in Tokyo were composed of students who had various severities of hearing losses, thus it was the one of the rules to use oral communication and sign language in the same classroom at that school. The chosen students used both of these communication modes in the class, because there were two deaf students in 5th grade. This component influenced the result of the communication modes by them.

In contrast, the Swedish students in the hearing class spontaneously only used oral communication at the school for the Deaf and Hard of Hearing in Gothenburg.

There were two types of classes, the hearing class and the deaf class, at the school in Gothenburg. The difference between the classes was the language students' first language. In the deaf class, sign language was their first language. In the hearing class which was observed, the class teachers and students focused on spoken language and the lessons were held in Swedish, because the students first language was spoken Swedish.

Influence of teacher preference of communication mode

In Tokyo, the class teacher often told the students to use oral communication and sign language if someone only used one of these communication modes. As the classes were composed of students with a hearing impairment and deafness, which were heterogeneous, the students used sign language and oral communication to understand each other.

However, the class teachers in Gothenburg gave priority to use oral communication and told them to speak louder and accurately if someone did not understand a statement.

Namely, the Swedish students in the hearing class have always had the educational setting which had stress on oral communication.

Tobey et al. (13) found higher speech intelligibility scores were associated with the educational settings which emphasize oral communication development. With the exception of 4-J, the Japanese students produced accurate prosody, but they had unclear articulation except 3-J. However, all Swedish students demonstrated accurate prosody in the sentences. The articulation produced was almost clear as normal hearing peers (Table 11).

Table 11. Summary of the comparison in each pair.

Pair	Communication mode	Quality of speech	
		Same	Different
1	Different	Accurate prosody.	Articulation.
2	Different	Accurate prosody.	Articulation.
3	Different	Accurate prosody.	Articulation.
4	Different	-	Articulation. Prosody.

As Geers et al. (14) presented, communication modes at each school have played an important part to develop the auditory and spoken language for the chosen students in Tokyo and Gothenburg.

Influence of parents' choice

Parents' choice is another important factor which influences communication modes. The parents of the eight students in the study were not included in the current study.
The student 4-J has deaf parents whose mother language was sign language. The student 4-J was diagnosed at three years of age and hearing aids were fitted. The time interval between the age of diagnosis and the fitting of hearing aids for 1-J was 3 years and 3 months. It seems that parents' choice may have influenced the detection of hearing loss and intervention of the hearing habilitation for them.

According to a staff at the school for the Deaf and Hard of hearing in Gothenburg, it is the parents who decide which class (hearing or deaf) their child participates. One of the criteria for attending the school in Gothenburg is children must have a hearing impairment and wear hearing aids bilaterally. At first, the parents choose a local school for their child to attend when the child has a hearing loss. However, if the child has the hearing aids bilaterally and hears poorly, the parents typically choose the hearing class. If the degree of the hearing loss is more severe, the parents usually choose the deaf class.

One study in the U.S. presented the results about the parental decision process. The parents of participants decided to get cochlear implants for their child, because they would have a child who might function as a hearing person and they felt frustration with the child's communication skills. Those parents were well-motivated to seek the additional information from medical personal and also another parent (15). The parents of the chosen Swedish students have chosen the hearing class for their child. It seems that they have probably wished that their child would acquire spoken language as the first language and have oral communication as the mode of communication among the family and the normal hearing persons.

In Japan, students with hearing impairment go to a school for the deaf or a mainstream school (16). The difference from Gothenburg is the final decision on school placement is done by the educational board in each ward, with regard to the parents' opinion (16). The parents of the

students decided which type of educational settings their child would receive. However, the final decision was made by the educational board in Tokyo where they have lived.

CONCLUSION

There is an obvious difference in the communication modes between the participants in Tokyo and Gothenburg.

- The Japanese students used oral communication and sign language, whereas the Swedish students spontaneously only used oral communication, although they had matched audiological criteria.
- There were differences in the average ages of diagnosis and beginning hearing aid use between the Japanese and Swedish students, but this was not statistically significant.
- The difference in the modes of communication between the participants may have been influenced by the interval of time between diagnosis and intervention.
- The educational setting emphasized oral communication, teacher preference of the communication modes in the class and the choice of the school placements made by parents in Gothenburg and by the educational board in Tokyo were the determiners of the mode of communication by the chosen students in Tokyo and Gothenburg.

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